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MIXING ZONE COMPLIANCE MONITORING PLAN

FORMER STANLEY TOOLS SITE FOWLERVILLE, MICHIGAN

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1. INTRODUCTION

This Mixing Zone Compliance Monitoring Plan was prepared for the Former Stanley Tools (FST) site located at 425 Frank St., in Fowlerville, Michigan. Until recently, Johnson Controls, Inc. (Johnson Controls) owned the entire FST site. Johnson Controls sold the eastern portion located outside of the flood plain to American Compounding Specialties, LLC, but retains responsibility for completing the RCRA corrective action requirements for the entire site. The Earth Tech, Inc. / Weston Solutions, Inc. Team (ETW) has been retained to provide professional services to help Johnson Controls meet these RCRA obligations.

In February 2004, a *Final Corrective Measures Proposal* (Final CMP) (ETW, February 2004) was prepared for the FST site and provided to the United States Environmental Protection Agency (USEPA). In September 2005 a Mixing Zone Determination request was completed by the USEPA and filed with the State of Michigan. The Michigan Department of Environmental Quality (MDEQ) provided responses to the Mixing Zone Determination Request in their correspondence to the USEPA titled, *Final Determination of a Mixing Zone Request; Johnson Controls, Inc. (former Stanley Tools); MID 099 124 299*, dated February 23, 2006. The MDEQ correspondence provided acute mixing zone-based groundwater surface water interface (GSI) values, as determined by the MDEQ, Water Bureau (WB), and requested that this Mixing Zone Compliance Monitoring Plan be prepared. The monitoring plan presents a sampling program intended to demonstrate that groundwater discharges to surface water will remain in compliance with the established mixing zone-based GSI criteria.

A RCRA Groundwater Monitoring Program Plan (GMP) was provided as Appendix E of the Final CMP, and was structured to include the periodic sampling of the same 11 GSI Compliance Wells included in this Mixing Zone Compliance Monitoring Plan. In fact, this monitoring plan is generally a compilation of pertinent sections of the GMP provided in the Final CMP. The objective of this monitoring plan is to summarize the means by which the concentration and migration rate of hazardous constituents in the groundwater will be evaluated for compliance to the mixing zone-based GSI criteria.

2. MONITORING WELL NETWORK

Currently there are a total of 57 monitoring wells located on- and off-site that have been used throughout the completion of the RCRA Facility Investigation (RFI) and the more recent project efforts conducted as part of the December 2002 Administrative Order on Consent (AOC). The AOC was a performance-based directive that emphasized the demonstration of environmental indicator controls and the development of long-term corrective measures. Johnson Controls accomplished applicable objectives of the AOC through the implementation of Interim Measures (IMs), the submittal of two Environmental Indicator Reports (CA 725 and CA 750), and submittal of a Final CMP in February 2004.

This Mixing Zone Compliance Monitoring Plan has been developed as part of the corrective action and monitoring program for the FST site to accomplish the following specific objectives:

- The primary objective is to assess the site's impact on the quality of groundwater pursuant to 40 CFR 265.93(d)(7) and Part 201.
- The short-term objective of the monitoring program will be to establish a new baseline of groundwater flow and contaminant conditions following the 2003 IM excavation, which removed overlying contaminant sources and disturbed the steady state aquifer conditions.
- The long-term objective of the monitoring program will be to assess the concentration and migration rate of hazardous constituents in the groundwater (including mixing zone chemicals) on a regular basis until final closure of the FST site.

Per 40 CFR 265.91, the groundwater monitoring system will be capable of yielding groundwater samples for analysis and will consist of at least one monitoring well installed hydraulically upgradient from the Solid Waste Management Units (SWMUs), and at least three monitoring wells installed hydraulically downgradient at the limits of the SWMUs.

Due to the documented presence of impacted groundwater at the FST site, a total of 17 wells have been selected for annual and semi-annual monitoring, as described in this Mixing Zone Compliance Monitoring Plan. A monitoring well location map is presented as **Figure 2-1**. The selected monitoring well network includes 11 wells designated to serve as GSI Compliance Wells, and six wells to serve as the points necessary to meet the other objectives of this plan.

As more fully described in Section 6.1, selected monitoring well samples will be analyzed for volatile organic compounds (VOCs), Michigan 10 metals plus nickel and hexavalent chromium, and total cyanide. In addition, monitored natural attenuation (MNA) parameters will be analyzed as part of the short- and long-term monitoring plan and corrective action objectives.

ETW evaluated the location and screen depth setting of each of the existing monitoring wells in relation to all SWMUs, potential receptors, property boundaries, the Red Cedar River, and the documented groundwater quality conditions across the study area. Based on that evaluation, a focused monitoring well network comprised of 17 wells has been identified to best accomplish the stated objectives of this monitoring plan. **Table 2-1** presents a detailed description of each selected well, including the well location, purpose, sampling frequency, and analytical parameters.

Of these 17 monitoring wells, two wells are located upgradient and 15 wells are located adjacent to, sidegradient, or downgradient of the regulated units/SWMUs. Eleven of the listed wells will be sampled on a semi-annual basis. Four of the five deep wells, and two wells located within the center of the VOC plume, will be sampled annually. **Table 2-2** summarizes the monitoring well construction details and recent water level elevation data for all wells at the FST site.

Eleven of the 17 monitoring wells in **Table 2-1** are designated as GSI Compliance Wells (points of compliance), as required by the AOC and described in the February 2004 Final CMP. The GSI Compliance Wells were selected based on the most significant groundwater exposure pathway for site contaminants, the Red Cedar River. A variety of selection factors were evaluated to designate which monitoring wells represented optimal points of compliance, including hydrogeological conditions (i.e. groundwater flow parameters in the shallow and deep aquifers), groundwater contaminant distributions and current cleanup criteria comparisons, and most significantly, the consideration of mixing zone and GSI impacts. The GSI Compliance Wells selected will provide the necessary groundwater monitoring capabilities required to demonstrate short- and long-term attainment of corrective action objectives.

3. FIELD SAMPLING PROTOCOLS

3.1 WELL MAINTENANCE PROGRAM

The following sections describe the well maintenance program that applies to all monitoring wells on- and off-site. All wells/protective casings were labeled in 2003 to increase well designation visibility and all wells were provided new, keyed-alike locks.

3.1.1 Well Inspection

The routine inspection of the monitoring system is important to ensure that the wells are in good condition and that no damage or other problems have occurred that might affect the monitoring program.

During each sampling event, all monitoring wells will be inspected for damage and/or security of the well covers. The inspection will include an assessment of cracking or splitting of the well apron, physical damage to the well cover, documentation of any evidence indicative of well tampering, operation of the locks on the wells, and all other tasks described in the Monitoring Well Inspection Checklist shown in **Table 3-1**. The inspection will also include recording the depth to the bottom of the well (to check for sedimentation inside the well) and the purge rate used for low flow sampling. This checklist will be completed for each well during each sampling event. In the event any well conditions are identified that require repair, the repair(s) will be completed as soon as practical. Copies of the checklists will be kept in the project file for the duration of the mixing zone compliance monitoring program.

3.1.2 Corrective Action

Table 3-2 lists the corrective actions to be performed if damage or other adverse conditions are observed at a monitoring well during a well inspection. When feasible, all corrective measures will be completed prior to the next sampling event.

3.2 WATER LEVEL MEASUREMENTS

Water level measurements will be collected from all monitoring wells at the FST site, including those not part of the mixing zone compliance monitoring program, in order to best characterize

site-wide groundwater flow conditions (**Table 2-1**). All readings will be collected within 24-hours of each other in order to obtain accurate information on aquifer conditions. The following protocols will be used during water level measurements:

- The water level probe and cable will be decontaminated prior to each use as indicated in Section 5.
- Wells caps/covers will be opened for a minimum of 15 minutes before water elevations are taken to allow water levels to equilibrate.
- Depth to water will be measured with an electrical sounding device (accuracy ± 0.01 feet). The reference point for this measurement will be the north side of the inner casing.
- The depth to water and the time will be recorded in the field notebook.
- Water levels will be obtained prior to initiating any monitoring well sampling activities.

3.3 GROUNDWATER PURGING AND SAMPLING

Groundwater samples will be collected from the 17 selected monitoring wells using low-flow sampling procedures. Sampling equipment will be decontaminated pursuant to protocols presented in Section 5. Each well will be purged and sampled using the following methodology:

- Note the existing condition of the well and wellhead. If the well designation is not visible on the outside of the riser or protective casing, add the designation as appropriate.
- Monitor the headspace of the well per the Health and Safety Plan as the well cap is removed.
- Measure the depth to water from the north edge of the inner casing.
- Slowly lower an appropriate length of clean tubing used with the peristaltic pump to the approximate mid-point of the screened interval.
- Immediately prior to purging, measure and record the depth to water. Start purging the well at a flow rate that maintains drawdown to 3 inches or less. Water-level measurements will be made continuously to document the stabilization. Every attempt will be made to have a maximum drawdown of 3 inches. If the recharge rate of the well is less than the minimum pumping rate, every attempt will be made so that drawdown does not proceed to the level below the intake of the tubing. All field issues will be documented, in detail, in the field logbook.
- Measure the pH, specific conductance, Eh, temperature, turbidity, and dissolved oxygen (D.O.) of the purge water from an in-line flow-through cell(s) every 5 minutes. There should be no air bubbles observed in the tubing.

- Continue purging until stabilization is achieved. Stabilization is defined as three consecutive readings that are within the following criteria:
 - pH: ± 0.1 unit
 - Specific conductivity: $\pm 3\%$
 - Temperature: ± 3 degrees C
 - Eh: ± 10 mV
 - D.O.: $\pm 10\%$
 - Turbidity: ± 10 NTU
- Continue pumping once purging is completed and reduce the flow rate to its lowest level and disconnect the tubing from the in-line flow-through cell.
- Collect groundwater samples directly from the end of the tubing into clean laboratory-prepared labeled bottles.
- Handle and ship the samples according to the procedures outlined in the remainder of this document.
- Metal analysis will be for total metals unless the last turbidity reading is greater than 10 NTU, then both filtered and non-filtered samples will be collected. A 0.45 micron filter will be used.
- After sample collection is complete, remove the pump and the tubing. Tubing will be properly disposed after the well is sampled.
- Measure the total depth of the well.
- Return all purge water, containerized in a bucket, back into the well at the completion of sampling.
- Secure the well by replacing the cap/cover/J-plug and locking the protective casing.

The above procedures will be used for collecting all types of samples including investigative and quality control (QC) samples. **Table 3-3** presents the well purging and sampling field data sheet to be used during all well sampling efforts.

3.4 SAMPLE IDENTIFICATION

A unique field sample identification code will be assigned to each sample collected. For water samples, the identification code will consist of the following three parts separated by hyphens:

Part 1		Part 2		Part 3
MW01	-	110303	-	01
Location		Collection Date		Sample Type
Identification	-	Identification Code	-	Identification
Code		(03 Nov 2003)		Code

3.4.1 Location Identification

The *Location Identification Code* will not exceed six characters in length. Location identification codes will be unique identifiers consisting of character codes that describe the sample type [i.e. well sample or Quality Assurance/Quality Control (QA/QC) sample] and location. Note that numbers 1-9 shall be written as two-digit numbers (i.e., 01-09).

3.4.2 Collection Date

The *Collection Date* portion of the sample identification code will not exceed six characters in length. The six-character date code will be:

MMDDYY

-MM—signifies a two-digit numeric code representing the month the sample was collected (01=January, 02=February, 03=March, 04=April, 05=May, 06=June, 07=July, 08=August, 09=September, 10=October, 11=November, 12=December).

-DD—signifies a two-digit numeric code representing the day the sample was collected. Valid values will include numbers from 01 to 31.

-YY—signifies a two-digit numeric code representing the year the sample was collected.

3.4.3 Sample Type

The *Sample Type* will be a two-digit number representing the sample QC type. The table below lists and describes the possible QC types.

QC Code	Description
01	Normal Sample
02	Field Duplicate Sample
03	Equipment Blank Sample
04	Trip Blank Sample

4. FIELD MEASURED PARAMETERS

This section describes the procedures for conducting field measurements of water level, turbidity, pH, Eh, D.O., temperature, and specific conductivity. This section also describes the procedures for maintaining the accuracy of all the instruments that will be used for conducting field measurements during the monitoring program.

4.1 FIELD MEASURED PARAMETERS

Seven parameters will be measured at each well location prior to collecting the groundwater samples. These parameters will include water level, turbidity, pH, Eh, DO, temperature, and specific conductivity.

A groundwater level measurement will be obtained at each monitoring well prior to purging using an electronic water level meter. Once purging has started, field parameters for turbidity, pH, Eh, D.O., temperature, and specific conductivity will be recorded every five minutes. The groundwater will be monitored until the parameters have equalized. Equalization is defined as three consecutive readings within the ranges specified in Section 3.3.

4.2 CALIBRATION PROCEDURES AND FREQUENCY

Instruments and equipment used to gather, generate, or measure environmental data will be calibrated with sufficient frequency and in such a manner that the accuracy and reproducibility of results are consistent with the manufacturer's specifications. All field instruments will be calibrated and maintained by trained personnel.

Equipment to be used during the field sampling will be examined to certify that it is in good operating condition. This includes checking the manufacturer's operating manual and the instructions for each instrument to ensure that all maintenance requirements are being observed. Field notes from previous sampling trips will be reviewed so that any prior equipment problem is not overlooked and all necessary repairs to equipment have been made.

Field instruments to be used at the site include:

- pH meter.
- Turbidity meter.

- Eh meter.
- D.O. meter.
- Thermometer.
- Specific conductance meter.
- Water level indicator/electronic sounding device.

The calibration and checkout of all field instruments will be performed prior to use each day. All calibration performed in the field will be documented in the field logbook. A master calibration/maintenance file will be maintained for each measuring instrument and will include, minimum, the following information:

- Name of device or instrument calibrated.
- Results of calibration.
- Name of person performing the calibration.
- Identification of the calibration media (e.g., pH buffer solutions).

5. DECONTAMINATION PROCEDURES

Field equipment used during field purging and sampling will be decontaminated prior to use to reduce contamination and cross-contamination in accordance with the guidelines and procedures set forth in this document. These procedures are necessary to ensure QC in decontamination of field equipment and to serve as a means to identify potential errors in the sample collection and sample handling procedures.

After the collection of the required samples, decontamination of all field sampling equipment, and field instruments will be conducted in a thorough and step-wise manner as described below. New disposable latex gloves will be worn when handling clean sampling equipment to ensure that the equipment is not contaminated. Decontamination procedures shall be documented in the field logbook.

All reusable sampling and monitoring equipment will be decontaminated between uses as follows:

- Rinse thoroughly with potable water.
- Scrub with Alconox and water wash to remove any visible residue.
- Rinse with deionized water.

After each sample container is filled and capped, it will be cleaned by wiping the outside surface thoroughly to remove dirt or other visible signs of potential contamination.

The exterior of each shipping container used to transport samples to the laboratory will be decontaminated in accordance with the following procedures:

- Place all the sample containers into the approved shipping container
- Wipe all outside surfaces of the cooler thoroughly to remove dirt or other visible signs of potential contamination.

All disposable field equipment will be disposed into a licensed sanitary landfill. The minimal volume of decontamination fluid will be disposed onto the ground surface at each well location.

6. SAMPLE ANALYSIS

A total of 17 monitoring wells will be sampled on an annual or semi-annual schedule, as part of this monitoring plan. Groundwater samples will be collected from 11 specified monitoring wells on a semi-annual basis (including 6 shallow GSI Compliance Wells MW-14, MW-17, MW-21, MW-22, MW-24, MW-26, and monitoring wells MW-11, MW-28, MW-28C, MW-B1, MW-OS3 for other purposes). Groundwater samples will be collected from six specified monitoring wells on an annual basis (including deep GSI Compliance Wells MW-B2, MW-J2, MW-OS1C, MW-OS3C, and monitoring wells MW-2 and MW-25 for other purposes). All groundwater samples will be analyzed by TriMatrix Laboratories, located in Grand Rapids, Michigan.

6.1 SITE-RELATED CHEMICALS

As described in **Table 2-1**, the monitoring well samples will be analyzed for VOCs, and/or Michigan 10 total and dissolved (if needed) metals, nickel, hexavalent chromium, and total cyanide. VOC samples will be collected in two 40 mL glass containers and preserved with hydrochloric acid to a pH less than 2. Analysis and detection limits will be in accordance with USEPA Method SW-846/8260. Non-filtered samples for total metals will be collected in a 500 mL HDPE container and preserved with nitric acid (HNO_3) to a pH of less than 2. Following the last turbidity reading, a field filtered sample for dissolved metals will be taken only if the turbidity is above 10 NTU, replaced in a 500 mL HDPE container, and preserved with HNO_3 to a pH of less than 2. All total and dissolved metal samples will be analyzed using USEPA Method SW-846/7000/6010. The hexavalent chromium sample will be containerized in a 250 mL HDPE bottle and cooled to 4 degrees Celsius. The total cyanide sample will be collected in an amber 500 mL container and preserved with sodium hydroxide (NaOH) to a pH of greater than 12. Selected cyanide samples will also be analyzed for free/amenable cyanide on a regular basis, if the detected total cyanide concentrations are greater than the Final Acute Value (FAV) of 44 ug/L. The holding time for preserved VOC samples is 14 days. The holding time for preserved metals samples is 6 months (13 days for mercury). The holding time for cyanide samples is 14 days. The holding time for hexavalent chromium is 24 hours. All analytical detection limits will meet the requirements set forth in MDEQ-RRD Operational Memorandum #2, Attachment 1.

6.2 NATURAL ATTENUATION ANALYSES

A MNA assessment will be made as part of the short-term groundwater monitoring program to aid in the determination of ongoing VOC breakdown processes already taking place within the shallow and deep aquifers at the FST site, and to provide an indication of the effectiveness of the 2003 IM source removal activities. In addition, the acquired MNA data can be used as needed to assess potential fate and transport conditions on- and off-site as an added safeguard to the conservative risk-based corrective measures program. Selected monitoring wells will be sampled for a variety of MNA parameters, including but not limited to:

- Oxidation-Reduction Potential (ORP)
- Sulfates/Sulfites
- Nitrates/Nitrites
- Ferrous/Ferric Iron
- Alkalinity
- Hardness
- Manganese
- Chemical Oxygen Demand (COD)
- Ethane and Ethene

During the first year of groundwater monitoring, shallow and deep groundwater will be tested at up to eight locations upgradient, within the center of the contaminant plume(s), and at the margins of the plume(s).

6.3 FINAL ACUTE MIXING ZONE-BASED GSI VALUES

The February 23, 2006 MDEQ correspondence letter provided final acute values for the mixing zone-based GSI criteria, as follows:

Parameter	Final Acute Value (µg/L)	Chronic Value (µg/L)	Reported Worst Case Maximum Site Concentration (µg/L)
Trichloroethylene	3,500	N/A	4,200
Arsenic	680	N/A	161
Cadmium	77	N/A	13

Parameter	Final Acute Value (µg/L)	Chronic Value (µg/L)	Reported Worst Case Maximum Site Concentration (µg/L)
Chromium, Hexavalent	32	N/A	20
Copper	144	N/A	103
Nickel	5,800	N/A	1,180
Cyanide, Free	44	N/A	10

The chemicals listed above are those that have been determined to have a reasonable potential to exceed the acute mixing zone-based GSI criteria, based on information provided in the MDEQ Mixing Zone Determination Request. The analytical results from the groundwater monitoring activities will be reviewed for exceedance of these values for the parameters listed above and to the generic GSI criteria for other chemicals not specifically identified as mixing zone-based chemicals. If exceedances are observed during the monitoring program, then contingency corrective measures will be taken as described in Section 6.4.

6.4 CONTINGENCY CORRECTIVE MEASURES

As excerpted from the Final CMP, based on the groundwater quality data collected during the short- and long-term monitoring program, contingency corrective measures will be implemented should the following "triggers" be observed and verified:

- A FAV for any site contaminant is exceeded in two consecutive monitoring events adjacent to the Red Cedar River.
- A seasonal exceedance of a FAV is determined over time.
- Detected concentrations of one or more site contaminants at a GSI Compliance Well exceed the mixing zone allowance for two consecutive monitoring events.
- A seasonal exceedance of one or more Mixing Zone Determination values (site-specific GSI criteria) is determined over time.

Contingency-based corrective measures will be implemented that include the following components:

- A general evaluation of the data collected to date;
- A human health and ecological risk screening of the data collected to date, with the "trigger" exceedances evaluated;
- If the risk screening indicates that a more thorough risk evaluation is required, and that acceptable results are achievable, then that risk assessment will be performed;
- Additional data collection efforts will be completed if they are required to complete the risk assessment;
- If risk assessment findings determine that the exceedance(s) are unacceptable, then targeted corrective measures focused on in-situ technologies will be designed and implemented per USEPA and MDEQ approvals.

7. QUALITY ASSURANCE/QUALITY CONTROL PROGRAM

The following section contains the QA/QC program for the Mixing Zone Compliance Monitoring Plan. The scope of the monitoring program includes field testing and measurement, as well as the collection and analysis of environmental samples. All tasks that include monitoring and measurement activities, and those that generate or process environmental data, will adhere to the QA/QC requirements described in this section.

7.1 SAMPLE HANDLING

All samples collected will be handled in a manner that maintains the integrity of samples and meets the regulatory requirements. In order for the sample to be representative, the following procedures will be used before, during, and after sample collection.

- Sample containers used for collecting samples will be certified clean.
- Sample containers will be pre-preserved under laboratory conditions. This technique will minimize the sources of contamination in the field.
- Sampling containers will be opened just before sample collection. The pre-preserved 40-ml containers will be immediately closed without any sample headspace after the sample has been collected to minimize the loss of VOCs. The pre-preserved metals and cyanide containers will be tested with pH paper after they have been filled to verify that they have been preserved to a pH of <2 and >12 for metals and cyanide analyses, respectively.
- To prevent contamination, the inside of the container will not be touched.
- To ensure VOC sample integrity, all gasoline or diesel engines will be turned off near and upwind of the sample locations. This precaution will prevent the introduction of VOCs into the sample.
- Samples will be collected in a manner that will minimize the introduction of foreign material such as rain, snow, and dust.
- Holding times, containers and preservatives as discussed in Section 6 will be strictly adhered to, in order to maintain sample integrity and meet regulatory requirements.
- Immediately upon collection, samples will be stored in an ice-filled cooler. Samples will be stored and shipped in a manner to keep temperatures at 4 degrees Celsius or less.
- Analytical methods discussed in Section 6 will be used. These analytical methods will most accurately and precisely represent the true concentration of the parameter of interest.

- Decontamination procedures as discussed in Section 5 will be used before and between sample collection to prevent contamination and cross-contamination of samples.

7.2 FIELD QUALITY CONTROL SAMPLES

Any contamination of samples resulting from sampling equipment, sample handling, and sampling techniques can be identified through the collection and analysis of field QC samples. The laboratory will be kept from using these samples for internal QC samples by indicating which samples are to be used for internal QC on the chain-of-custody record. The following subsections detail the type and number of field QC samples that will be collected during the monitoring program.

7.2.1 Field Blanks

Field blank samples are collected and analyzed to check for procedures at the site that may cause sample contamination. A common type of field blank sample is the field equipment blank. One field equipment blank will be collected during each sampling event.

Field equipment blanks will be obtained by transferring ultra-pure water through clean sample tubing into a sample container. Each field equipment blank will be analyzed for the same parameters as the investigative samples and in accordance with the same analytical methodologies. When collecting a field blank, the sample for VOCs will be collected first, followed by other parameters. All field blanks will be identified as such on all sample documentation.

7.2.2 Trip Blanks

Trip blanks are used to assess the potential for contamination of samples due to contaminant migration during sample shipment and storage. Trip blanks generally pertain to VOC samples only and are prepared prior to the sampling event by the laboratory in 40 mL vials and are kept with the investigative VOC samples throughout the sampling event. They are then packaged for shipment with the other VOC samples and sent for analysis.

One trip blank will accompany every shipment containing VOC samples. Trip blanks will be analyzed only for VOCs in accordance with the analytical methodologies of investigative VOC samples.

7.2.3 Field Duplicate Samples

Field duplicate samples will be collected from selected monitoring wells at a frequency of 1-per-10 investigative samples, using procedures identical to those used for the investigative samples. Duplicate samples will be analyzed for the same parameters as the investigative samples. Duplicate samples will be collected by alternately filling two sets of sample bottles from the same sampling equipment. The VOC fraction for each duplicate sample will be collected immediately after the VOC fraction for the investigative sample to minimize the possibility of loss of VOCs during sample collection.

7.2.4 Matrix Spike/Matrix Spike Duplicate Samples

Matrix Spike/Matrix Spike Duplicate (MS/MSD) samples will be collected from selected monitoring wells at a frequency of 1-per-20-investigative samples, using procedures identical to those used for the investigative samples. MS/MSD samples will be analyzed for the same parameters as the investigative samples. MS/MSD samples will be collected by alternately filling two sets of sample bottles from the same sampling equipment. The VOC fraction for each duplicate sample will be collected immediately after the VOC fraction for the investigative sample to minimize the possibility of loss of VOCs during sample collection.

7.3 LABORATORY QUALITY CONTROL PROGRAM

The overall QC objectives for laboratory analyses are to produce data of known and sufficient quality. Appropriate procedures and quality control checks will be used so that known and acceptable levels of accuracy and precision are maintained for each data set. This section defines the objectives for accuracy, precision, and completeness, for measurement data. How the accuracy, precision, and completeness results will be assessed is also discussed in the following subsections.

7.3.1 Accuracy

Accuracy of measurement data is defined as the degree of agreement between a measurement, X , with an accepted reference or true value, T . It is usually expressed as the difference between the two

values, $X-T$, the difference as a percentage of the reference of true value $100(X-T)/T$, and sometimes expressed as a ratio, X/T . These expressions give a measure of the bias in a system.

7.3.1.1 Accuracy Goals for Laboratory Measurement

Accuracy of laboratory analyses will be assessed using the following quality control checks: calibration standards, surrogate spikes of all samples, laboratory control samples (LCS), and matrix spikes of selected samples collected in the field. Surrogate spike, LCS, and matrix spike results will be expressed as a recovery of an analyte added to the sample at a known concentration:

$$\text{Percent Recovery} = \text{SSR} - \text{SR} / \text{SA} \times 100 \text{ Percent}$$

Where:

SSR = spiked sample result
SR = sample results (not applicable for surrogate recovery)
SA = amount of spike added

Calibration check standards are expressed as a percent difference from the true value, i.e., $100(X-T)/T$. The frequency and acceptance criteria for the accuracy quality control checks for groundwater analyses will be in accordance with the laboratory Quality Assurance Project Plan (QAPP) in **Appendix A** of this monitoring plan.

7.3.1.2 Accuracy Assessment

Results of quality control checks which monitor accuracy will be evaluated against the acceptance criteria and advisory limits shown. If the results are outside the criteria, then data validators will determine if the associated data is 1) left unqualified and identified as usable; 2) qualified as "J", estimated; or 3) qualified as "R", unusable. If feasible, an estimated amount of bias in the "J" results and unqualified results will be made and taken into account in using the data. Data qualified as "R" will not be used.

7.3.2 Precision

Precision is a measure of mutual agreement among individual measurements of the same property, usually under prescribed similar conditions. Precision is expressed as a standard

deviation among a group of measurements or as a relative percent difference between two measurements.

7.3.2.1 Precision Goals for Laboratory Measurements

Precision of laboratory analysis will be assessed by analyzing duplicate samples or matrix spike duplicates, blank spike duplicates, and/or by analyzing aliquots (sample replicates) of one sample. Analysis of duplicate samples measures the precision of both the sampling and analysis, whereas a sample replicate, generally measures only the analytical precision. Precision of the duplicate and replicate analyses will be expressed as a relative percent deviation (RPD) for evaluation of two results, and relative standard deviation (RSD) for evaluation of three or more results. The frequency, acceptance criteria, and corrective actions for duplicate and replicate samples will be in accordance with the laboratory QAPP (**Appendix A**).

7.3.2.2 Precision Assessment

Results of QC results which monitor precision will be evaluated against the goals, indicated in the laboratory QAPP (**Appendix A**). The results of laboratory duplicates and replicates in the field will indicate the amount of variability in the measurement process. Those percent RPDs which are outside the criteria will be taken into account as data is evaluated. The results of collected samples duplicates will indicate the amount of variability in 1) the sample matrix, 2) sampling technique, and 3) analytical technique. Since the three sources of variability cannot be distinguished in the results and the sample matrix may not be altered to improve the variability, the percent RPD results will be noted. The variability in one sample may not represent variability for all investigative samples, but will serve as a general indicator of sample variability. Sample conditions, constituents, and location will be taken into account in this assessment.

7.3.3 Completeness

Completeness is a measure of the amount of data obtained from a measurement system that achieves the project goals, compared to the amount expected under normal conditions. Completeness is affected by unexpected conditions that may occur during the data collection process. Occurrences that reduce the amount of data collected include events such as a dry

well, an instrument breakdown, or a loss of sample extract. All reasonable attempts will be made to minimize loss of data (e.g., through regular maintenance of instruments, and replacing/repairing instruments that have broken down and to recover lost data.

7.3.3.1 Completeness Goals for Laboratory Measurements

Completeness goals for this program have been established for laboratory analyses. The completeness goal for each individual laboratory analyses is 90 percent. For critical data points, consisting of one upgradient data point, the completeness goal for sample collection and analysis is 100 percent. The following equation will be used for calculating completeness of laboratory analyses:

$$\text{Completeness} = \text{Number of valid data points} / \text{Number of data points collected} \times 100 \text{ Percent}$$

Difficulties encountered during the sampling handling in the laboratory, as well as unforeseen complications regarding analysis methods may affect completeness during sample analysis. For example, the analytical methods proposed for use (particularly for the organic analyses) are intended for analysis of "environmental samples" (low- and medium-level), and the applicability of these methods to unknown or hazardous-level samples may result in poor method performance and would, therefore, have an adverse impact on achieving the data completeness goal. Valid data points are defined as those results identified as usable for the intended purpose.

7.3.3.2 Completeness Assessment

Completeness will be monitored and assessed by the following guidelines:

1. Completeness of laboratory results will be monitored as data are validated. Those results identified by the validators as unusable due to laboratory performance and those results identified by the data users as unusable due to the amount of bias in the results are considered not valid. The necessity for re-sampling to retrieve valid data points will be assessed on a case-by-case basis and will be based on:
 - Whether the incomplete data point is a critical data point;

- Whether the invalid analyte(s) is a parameter of concern at the site; and
 - Whether there are enough data points to accomplish the purpose of the investigation.
2. Completeness of the samples collected will be monitored during sample collection to ensure that all planned locations and depths are completed. If a sample location is not obtained, the field manager will ensure that every reasonable attempt is made to collect the sample(s). If conditions do not allow the sample(s) to be collected, then the appropriate project managers will be notified and the deviation documented for the files.
3. Completeness of field measurements will be monitored during field activities to ensure that all field measurements and associated QC checks are performed. Field measurements taken without the required QC checks will be considered incomplete.

7.4 FIELD DATA DOCUMENTATION

Field logbooks will be assigned to individual field personnel for the duration of their stay in the field, but will be stored at an appropriate document management area when not in use. Field data sheets, sampling sheets, notebooks, and records will be marked with the project work order number. This number will allow for data generated during the monitoring program to be traced back to the project. Identification of paperwork with this number will help prevent loss of data during its use and assimilation by allowing misfiled or misplaced documents that are found to be traced to the appropriate file.

All data collection activities performed at a site will be documented in a bound field logbook with numbered pages. The entries will be as detailed and descriptive as possible so that a particular situation can be recalled without reliance on the collector's memory. All field logbook entries will be dated.

The cover of each logbook will contain the following information:

- Logbook number.
- Project name.

- Project work or control number.

To ensure the most useful, organized, and complete field notes, the following procedures for setting up and using a field logbook will be followed:

- Field logbooks will be issued only to field personnel actively involved in a task.
- Each book will be identified by the project-specific work number.
- The title page of each logbook will contain:
 1. Person and name of organization to which the book is assigned.
 2. Book number.
 3. Project work or control number.
 4. Location and activity for logbooks designated to specific tasks.
 5. Start date.
 6. End date.
- Entries into the logbook will contain a variety of information. Each entry will include some or all of the following, as appropriate:
 1. Date and time.
 2. Name of individual making the entry.
 3. Description of test/activity.
 4. Quantities of any materials used.
 5. Drawings and information related to activity as necessary.
 6. Conditions that might adversely affect the test/activity.
 7. Names of witnesses, observers, or others present.
 8. Samples collected, received, or released, including description of sample, sample number, and sample collection time.
 9. Deviations from the approved procedures for that activity.
 10. Data that are not recorded by automatic methods.
 11. Level of personnel protection equipment (PPE) being used.
 12. Description of the sample location, including distance to grid nodes or other permanent features.
 13. Numerical designation for any photographs taken.
 14. Listing of equipment used to make field measurements.
 15. Calibration data for field instrumentation.

16. Calculations performed.
 17. Date and reason for downtime or delays.
 18. Visitors and purposes of the visit.
 19. Weather conditions.
- The log will be closed at the end of each day's activity, with the time and signature of the person making the last entry.
 - Log openings and closings will have no open lines in between so that no unauthorized entries can be made.
 - All entries will be described in as much detail as possible so that reconstruction of events does not depend on memory. (Examples of such detail include locations, samples, descriptions, depths, containers, measurements, equipment, dates of calibration, photographs, etc.)
 - All entries will be made in waterproof, black or blue indelible ink, with no erasures.
 - Corrections to entries will be made by crossing out the error with one line, dating and initialing the error, and entering the correction above or beside the error. Each page entered on in the logbook will be signed and dated by the individual. Once an entry has been signed and dated, changes, deletions, or additions are made only as a new entry and refer back to the original entry rather than crossing it out. A new page in the field notebook will be started when the previous page is full or when the previous page has been marked, dated, and signed so that no entries can be made. Pages shall not be removed from the bound notebook.

7.5 CHAIN-OF-CUSTODY PROCEDURES

Sample custody procedures to be followed during the groundwater monitoring field activities require that the possession and handling of each sample from the moment of its collection through analysis be documented by written record. A sample is in someone's custody when one of the criteria listed below has been satisfied:

1. The sample is in one's actual possession.
2. The sample is in one's view after being in one's physical possession.
3. The sample is in one's physical possession and is then locked up so that no one can tamper with it.
4. The sample is kept in one's possession and is then stored in a secured area that is restricted to authorized personnel only.

Samples will consist of material collected in the field, such as water, and any reagents added for

the purpose of sample preservation.

7.5.1 Sample Labels

All samples will be identified with a label attached directly to the container. Sample label information will be completed prior to filling the container with the sample using waterproof blue or black ink. The labels will contain the following information:

- Sample number.
- Date of collection.
- Installation name.
- Parameters to be determined.
- Preservative (if any).
- Sample source/location depth.

7.5.2 Chain-of-Custody Record

To maintain a record of sample collection, transfer between personnel, shipment, and receipt by the laboratory, a chain-of-custody form will be filled out for each sample as it is collected by the field sampler. Each time the samples are transferred, the signatures of the persons relinquishing and receiving the samples, as well as the date and time of transfer, will be documented.

Chain-of-custody seals will be used to determine if any tampering has occurred during shipment of samples. These signed and dated seals or other tamper-evident locking device will be placed on all shipment containers by the person responsible for packaging. If the chain-of-custody seals are not intact at the time the shipping containers are received by the laboratory, the laboratory project manager will notify the field manager within 24 hours of container receipt.

7.5.3 Transfer of Custody and Shipment

Prior to shipment of samples, the chain-of-custody record will be signed and dated by the field sample custodian who has verified that those samples indicated on the record are indeed being shipped. A copy of each chain-of-custody form will be retained in the project files, and the original will be sent with the samples (sealed inside the shipping container). After packaging has been completed, custody seals, signed and dated by a member of the field team, will be placed on the shipping container.

Samples collected will be handled and shipped in a manner that will protect against any detrimental effects on the samples or the environment due to breakage, leakage, or spoilage. Sample handling procedures will be closely supervised and recorded to minimize the potential for loss, modification, or tampering during shipment to the analytical laboratory. Package labeling specifications will depend on the type of materials being sent, and will be in accordance with Department of Transportation (DOT) regulations (49 CFR, Parts 171 through 177) and International Air Transport Authority (IATA) guidelines. Samples of hazardous materials will be stored and handled in accordance with all applicable Federal and State requirements.

7.5.4 Laboratory Custody Procedures

Sample custody procedures in the laboratory include the procedures for general security, sample receipt, storage, preparation and analysis. The following subsections describe the minimum general requirements that will be followed by the laboratory.

7.5.4.1 Sample and Hardcopy Data Custody and Control

For a sample or for hardcopy data generated from analyzing a sample to be handled according to legal COC requirements, it must be:

- in the physical possession of an authorized field or laboratory staff member, or authorized transferee, or
- after physical possession of an authorized staff member, in the staff member's view, or
- secured (after physical possession) to prevent tampering, or
- placed in a designated secure area with restricted access.

Any change of possession or custody is documented on a COC form, and must include the names of the individuals relinquishing and receiving the sample or data. The date and time of transfer is also noted. Any correction to COC information is made by drawing a single horizontal line through the incorrect entry, and printing the correct entry adjacent to the original entry. All corrections are initialed and dated.

The person responsible for initiating COC in the laboratory is the receiving clerk. The receiving clerk signs and dates the COC form. The samples are then assigned unique, sequential six-digit identification numbers by the Laboratory Information Management System (LIMS).

Once the receiving clerk has logged in and documented the receipt of the sample, the sample is relinquished to the sample custodian on duty. The sample custodians and the supervisor of the Sample Control department have keys that unlock the sample storage coolers. Samples are filed in walk-in coolers until laboratory staff request specific samples by completing internal COC forms or batch sheets. The internal COCs are completed the same way, and the sample custodian relinquishes the samples to the laboratory staff member. The internal COC form is used to document the sample's movement from the custodian to the analyst to final disposition.

The sample custodian is responsible for purging raw samples from cold storage at the prescribed time. Unused raw samples are stored in a controlled temperature environment for 60 days after data submission to the client. Sample report dates are documented in the LIMS. Sample labels are color coded and placed in the cooler by date of receipt, allowing bottles to be easily retrievable from the storage unit shelves, once segregated by the sample custodian, the hazardous waste technician completes the preparation for discarding the identified samples for hazardous waste disposal.

Each laboratory area has its own planner from the Production Planning and Control (PP&C) department. Daily worklists are generated from the LIMS to assist PP&C staff in scheduling samples for preparation or analysis. The person who prepares or analyzes the sample accepts possession of the sample. Samples are transferred by cart, under COC, from the walk-in cooler to the laboratory area in which the samples are needed.

The LIMS schedules the appropriate analyses for samples and automatically tracks the progress of samples through the laboratory. The custody of a sample may be determined at any time by reviewing the scheduling details within the LIMS. Signatures and employee ID numbers on the internal COCs, sample preparation and analytical worksheets, and sequence run logs are used as a paper trail to document the physical transfer of the samples, and to document exactly who handled the samples at each stage of processing.

Hardcopy reports are stored and numbered to maintain strict document control. The document control clerk maintains an inventory of all hardcopy data stored. Hardcopy data are filed according to case and sample deliver group (SDG) member. The data are stored both at an off-site warehouse and in the laboratory in a secured area accessible by authorized entry only.

7.5.4.2 Electronic Data Custody and Control

The mainframe and minicomputer systems at TriMatrix Laboratories are secured by using assigned log-on accounts and individual passwords. Menu options are available to authorized users only, and are controlled by software that uses local attributes. These local attributes are created and maintained by the computer operations analyst. Users are allowed access only to those portions of the systems that are necessary for them to do their jobs.

Numerous forms, worksheets, and sequence run logs are generated from the computer systems and include analytical worksheets and the sample record. Individual laboratory non-analytical Standard Operating Procedures (SOPs) contain examples of these forms with instructions for completing them. Analytical results are reported on certain form templates either through direct electronic transfer from the instrument, indirect transfer via a local area network (LAN) linked to the instrument, or through manual data entry. All three mechanisms have specific security and QC features.

7.5.4.3 Logging in Samples

Bench Procedures

The following steps are completed for all samples as they are received by TriMatrix Laboratories.

Each sample container is inspected before it is opened to make sure that it has not been damaged or opened during shipment. Any padlocks, sealing tape, or custody seals on the samples are inspected to make sure that they are intact, and any observations are recorded on the COC form. If the custody seals, tapes, or padlocks are broken, the commercial client is contacted through Customer Service for permission to continue processing.

Vials containing samples to be analyzed for VOCs are checked to ensure that there is no headspace or air bubbles. Sample identification information on the bottles is compared to the Traffic Reports (TRs), packing lists, and COC form included in the container. Any discrepancies are noted on the COC by the receiving clerk. The Customer Service department notifies commercial clients if there are discrepancies.

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Sample Control department personnel accept custody of samples by signing and dating the COC form. Samples are logged onto a Commercial Receiving Log Sheet. The following items, where applicable, are noted on the sheet:

- case number
- matrix
- TriMatrix ID number
- temperature
- client name or order number
- analysis codes
- field ID (sample ID)
- volume received
- receiving date (RD)
- pH (inorganics only)*
- sampling date (SD)
- SampleSaver number

*Aqueous volatile sample pH is taken after analysis and documented in the data report.

The condition of the refrigerant (whether any ice remains or whether the cooling packs are solid) is checked and the temperature of a representative sample (liquid samples only) is ascertained by wrapping a temperature strip around the outside of the container. When it is apparent through these checks that a sample was not properly preserved, the client is notified and a standard QA Notice is completed and placed in the sample file.

On each COC that is complete and correct, the statement Received in Good Condition is written or stamped, initialed, and dated by the receiving clerk. This statement indicates that the sample or group of samples were received intact with correct sample tags or custody seals (if applicable), pH (applicable to inorganic samples), and corresponding documentation.

Each log sheet and COC is reviewed by the Sample Control department supervisor who ensures that all information is properly documented. Each is stamped as having been reviewed, initialed, and dated.

8. GROUNDWATER MONITORING REPORTS

8.1 SEMI-ANNUAL REPORT

The first semi-annual sampling event of each year, conducted in accordance with this monitoring plan, will be documented through the preparation of a Semi-Annual Groundwater Monitoring Report for submittal to the USEPA (and MDEQ as required). These reports will provide the following information:

- Copies of laboratory analytical data sheets.
- Field log sheets.
- A text description of the field effort and analytical QA/QC results.
- A tabular summary of analytical results.

Semi-Annual Groundwater Monitoring Reports will be submitted to the agencies within 45 calendar days after the end of the first half of each calendar year.

8.2 ANNUAL REPORTS

By March 1st of each year an Annual Groundwater Monitoring Report will be submitted to the USEPA (and MDEQ as required) in accordance with 40 CFR 265.94. The Annual Report will contain all of the information cited for the Semi-Annual Report, with the addition of the following information:

- A text description of groundwater flow conditions, groundwater chemistry results and observed trends, and any maintenance activities conducted on the groundwater monitoring system.
- Site maps illustrating the potentiometric surface contours for the two sampling events and the locations of observed Part 201 groundwater cleanup criteria exceedances.
- Text summaries of MNA findings.
- Text summaries of MDEQ Mixing Zone-required analyses.

Each Annual Groundwater Monitoring Report will also include a Conclusions and Recommendations Section to specifically document Johnson Controls assessment of the GMP effectiveness based on historical and newly gathered site data, and to identify if needed,

SECTION 8

modifications to this Mixing Zone Compliance Monitoring Plan or corrective measures strategies. The effectiveness assessment will consider a variety of factors, including:

- Regulatory changes such as cleanup criteria and analytical methods modifications.
- The emergence of new/improved sample collection and field measurement methods.
- Observable changes in groundwater quality conditions such as localized contaminant concentration spikes or conversely, verifiable reductions in plume dimensions.
- FAV exceedances or other specific “triggers” to the contingency-based corrective measures program.
- The level and significance of observed natural attenuation processes.
- Mixing zone considerations.
- Monitoring well conditions and locations.

Based on this evaluation of the Mixing Zone Compliance Monitoring Plan effectiveness, recommendations will be presented for USEPA concurrence (and MDEQ as required) to modify the monitoring plan, such as:

- Add or remove wells from the Mixing Zone Compliance Monitoring Plan.
- Add or remove analytical parameters, including site contaminants and MNA parameters (especially organics, based on slight GSI exceedances observed to date and the beneficial effects of the 2003 IM source removals).
- Modify the sampling frequency for some or all of the GSI Compliance/monitoring wells.
- Change components of the corrective action program for groundwater, based on the contingency-based parameters cited in the Final CMP. Appropriate reporting requirements would also be identified.

FIGURES



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TABLES

**Former Stanley Tools
Fowlerville, Michigan**

* Note: MNA parameters will be analyzed from selected well samples as described in Section 6.2

Table 2-2
Monitoring Well Construction and Water Level Elevation Summary
Former Stanley Tools Site
Fowlerville, Michigan

Well ID#	Original Ground Surface(ft) pre-IM	Present Ground Surface(ft) as of 12/03	TOC (ft)	Well TD from Original GS	Boring TD from Original GS	Screen Length (ft)	Top of Screen Elevation (ft)	Bottom of Screen Elevation (ft)	October 6, 2003		October 9, 2003		October 13, 2003		October 17, 2003		October 21, 2003		November 3, 2003		December 3, 2003		December 3, 2003		December 18, 2003	
									Depth to Water (ft)	Water Elevation (ft)	Depth to Water (ft)	Water Elevation (ft)	Depth to Water (ft)	Water Elevation (ft)	Depth to Water (ft)	Water Elevation (ft)	Depth to Water (ft)	Water Elevation (ft)	Depth to Water (ft)	Water Elevation (ft)	Depth to Water (ft)	Water Elevation (ft)	Depth to Water (ft)	Water Elevation (ft)	Depth to Water (ft)	Water Elevation (ft)
MW-01	888.96	888.24	891.91	13.00	15.00	5.00	880.96	875.96	9.08	882.83	9.13	882.78	9.21	882.70	8.55	883.36	8.93	882.98	8.09	883.82	8.23	883.68	8.23	883.68	8.49	883.42
MW-02	888.09	888.19	890.38	14.00	30.00	2.50	876.59	874.09	8.01	882.37	8.02	882.36	8.02	882.36	7.89	882.49	7.94	882.44	7.56	882.82	7.48	882.90	7.48	882.90	7.59	882.79
MW-03	888.14	888.48	890.70	15.00	15.00	5.00	878.14	873.14	8.26	882.44	8.28	882.42	8.27	882.43	8.10	882.60	8.19	882.51	7.72	882.98	7.68	883.02	7.68	883.02	7.79	882.91
MW-03C	888.17	888.07	890.11	47.00	48.00	10.00	851.17	841.17	7.63	882.48	7.68	882.43	7.65	882.46	7.50	882.61	7.56	882.55	7.79	882.32	7.10	883.01	7.10	883.01	7.18	882.93
MW-04	887.91	887.97	889.84	14.00	15.00	10.00	883.91	873.91	7.59	882.25	7.62	882.22	7.61	882.23	7.44	882.40	7.57	882.27	6.90	882.94	6.88	882.96	6.88	882.96	7.01	882.83
MW-05	888.53	888.73	891.14	14.00	15.00	5.00	879.53	874.53	8.96	882.18	8.97	882.17	8.96	882.18	8.82	882.32	8.88	882.26	8.52	882.62	8.48	882.66	8.48	882.66	8.56	882.58
MW-06	887.88	888.09	890.72	15.00	15.00	5.00	877.88	872.88	8.41	882.31	8.42	882.30	8.41	882.31	8.30	882.42	8.35	882.37	8.05	882.67	7.93	882.79	7.93	882.79	8.02	882.70
MW-07	886.27	886.27	885.95	18.50	30.00	7.50	875.27	867.77	3.50	882.45	3.51	882.44	3.56	882.39	3.42	882.53	3.45	882.50	-	-	3.10	882.85	3.10	882.85	3.15	882.80
MW-08	887.27	886.81	890.19	10.00	12.00	5.00	882.27	877.27	9.18	881.01	9.12	881.07	9.10	881.09	9.05	881.14	9.11	881.08	8.58	881.61	8.68	881.51	8.68	881.51	8.81	881.38
MW-09	887.95	887.27	889.81	11.00	13.00	5.00	881.95	876.95	7.90	881.91	7.89	881.92	7.85	881.96	8.42	881.39	7.78	882.03	7.48	882.33	7.38	882.43	7.38	882.43	7.50	882.31
MW-09B	887.41	887.47	890.42	35.00	37.00	5.00	857.41	852.41	8.55	881.87	8.55	881.87	8.50	881.92	7.74	882.68	8.47	881.95	8.12	882.30	8.07	882.35	8.07	882.35	8.16	882.26
MW-09C	887.85	887.20	890.49	53.00	55.00	5.00	839.85	834.85	8.57	881.92	8.71	881.78	8.50	881.99	8.52	881.97	8.55	881.94	-	-	8.08	882.41	8.08	882.41	8.17	882.32
MW-10	887.18	887.23	889.95	12.00	14.00	5.00	880.18	875.18	8.85	881.10	8.71	881.24	8.66	881.29	8.59	881.36	8.64	881.31	8.30	881.65	8.22	881.73	8.22	881.73	8.35	881.60
MW-11	887.92	887.52	890.93	14.00	34.50	10.00	883.92	873.92	9.61	881.32	9.58	881.35	9.57	881.36	9.42	881.51	9.57	881.36	8.92	882.01	9.15	881.78	9.15	881.78	9.30	881.63
MW-12	885.68	885.68	885.33	20.00	20.00	7.50	873.18	865.68	2.79	882.54	2.81	882.52	2.82	882.51	2.75	882.58	2.76	882.57	-	-	2.41	882.92	2.41	882.92	-	-
MW-13	880.72	880.72	882.56	10.00	10.00	5.00	875.72	870.72	4.03	878.53	4.13	878.43	4.13	878.43	3.54	879.02	3.64	878.92	2.51	880.05	2.88	879.88	2.88	879.88	2.80	879.76
MW-13C	880.73	880.73	882.81	38.00	38.00	5.00	847.73	842.73	4.01	878.80	4.07	878.74	4.13	878.68	3.59	879.22	3.71	879.10	2.69	880.12	2.88	879.93	2.88	879.93	2.99	879.82
MW-14	883.54	883.54	883.14	14.00	14.00	5.00	874.54	869.54	4.26	878.88	4.38	878.76	4.41	878.73	3.43	879.71	4.04	879.10	2.82	880.32	3.53	879.61	3.53	879.61	3.56	879.58
MW-14C	883.33	883.33	882.91	40.00	41.00	5.00	848.33	843.33	3.82	879.09	3.91	879.00	3.93	878.98	3.84	879.07	3.60	879.31	2.51	880.40	3.03	879.88	3.03	879.88	3.13	879.78
MW-15	881.74	881.74	884.37	10.00	10.00	5.00	876.74	871.74	5.74	878.63	5.84	878.53	5.85	878.52	5.32	879.05	5.49	878.88	4.26	880.11	4.78	879.59	4.78	879.59	4.85	879.52
MW-15C	881.58	881.58	883.50	29.00	29.00	5.00	857.58	852.58	4.31	879.19	4.37	879.13	4.39	879.11	3.95	879.55	4.08	879.42	3.09	880.41	3.39	880.11	3.39	880.11	3.46	880.04
MW-17	885.99	886.09	888.46	9.00	12.00	5.00	881.99	876.99	7.45	881.01	7.45	881.01	7.46	881.00	7.34	881.12	7.41	881.05	6.98	881.48	6.97	881.49	6.97	881.49	7.09	881.37
MW-18	883.95	886.17	889.14	9.00	10.00	5.00	879.95	874.95	8.33	880.81	8.10	881.04	8.03	881.11	7.94	881.20	8.00	881.14	7.64	881.50	7.57	881.57	7.57	881.57	7.68	881.46
MW-19	883.90	883.21	886.88	10.00	12.00	5.00	878.90	873.90	4.87	882.01	4.83	882.05	4.85	882.03	4.76	882.12	4.78	882.10	4.50	882.38	4.30	882.58	4.30	882.58	4.45	882.43
MW-20	882.46	882.55	884.86	9.00	12.00	5.00	878.46	873.46	4.59	880.27	3.94	880.92	5.27	879.59	4.91	879.95	5.03	879.83	3.99	880.87	4.95	879.91	4.95	879.91	4.56	880.30
MW-21	881.93	881.93	884.93	12.00	12.00	5.00	874.93	869.93	Not Installed	-	Not Installed	-	Not Installed	-	Not Installed	-	Not Installed	-	Not Installed	-	Not Installed	-	Not Installed	-	5.11	879.82
MW-22	881.21	881.55	883.32	10.00	17.00	5.00	876.21	871.21	4.78	878.54	4.78	878.54	5.00	878.32	4.50	878.82	4.76	878.56	3.70	879.62	4.44	878.88	4.44	878.88	4.35	878.97
MW-23	880.26	880.55	882.91	10.00	11.00	5.00	875.26	870.26	3.73	879.18	3.74	879.17	4.08	878.83	3.43	879.48	3.63	879.28	2.67	880.24	3.01	879.90	3.01	879.90	3.04	879.87
MW-24	881.10	881.14	883.72	10.00	10.00	5.00	876.10	871.10	Not Installed	-	Not Installed	-	Not Installed	-	Not Installed	-	Not Installed	-	3.64	880.08	4.05	879.67	4.05	879.67	4.07	879.65
MW-25	887.51	887.35	889.22	11.00	13.00	5.00	881.51	876.51	7.96	881.																

Table 3-1
Monitoring Well Inspection Checklist
Former Stanley Tools Site
Fowlerville, Michigan

Well Number: _____ Inspector: _____ Date: _____

- A. Is the access route to the well passable? _____
- B. Is the vicinity of the well clear of brush debris? _____

Runoff Diversion Apron

- A. Is the grout in good condition? _____
- B. Approximate diameter of apron: _____
- C. Does apron completely surround well casing? _____
- D. Does apron promote fluid drainage away from well bore? _____
- E. Are fluids being funneled into annular space around well casing? _____

Well Riser

- A. Is well riser intact? _____
- B. Is the well riser cracked, broken or bent? _____
- C. Is the well riser lifted? _____
- D. Is the survey mark visible for water level measurement reference? _____
- E. Is the riser cap in place and in good condition? _____

Protective Well Casing

- A. Describe the condition of the protective casing (intact, cracked, broken, bent, or lifted?) _____
- B. Is protective well casing lid equipped with a working lock? _____
- C. Are the drainage or weep holes clear? _____
- D. Is the well designation clearly visible on the outside of the protective casing? _____

Well Siltation

- A. Is the measured total depth of the well consistent with construction records? _____
- B. Does silt or sand exceed 6 inches in thickness on the well bottom? _____

Additional Observations and Remarks: _____

Table 3-2
Monitoring Well Corrective Actions
Former Stanley Tools Site
Fowlerville, Michigan

Negative Finding	Corrective Action
General	
Inaccessible well	Notify appropriate site contact to remove obstructions
Runoff Diversion Apron	
Poor Grout Condition	Replace Grout
Diameter of Apron < 6 inches	Replace Apron
Broken Apron	Replace Apron
Sunken Apron	Replace Apron
Well Riser	
Broken Riser	Determine Cause and Replace Riser
Lifted Riser	Determine Cause and Replace Riser
Unclear Survey Mark	Resurvey New Mark
Missing or Damaged Riser Cap	Replace Riser Cap
Protective Well Casing	
Broken Casing	Repair or Replace Casing
Casing Lid Missing Lock or Lock Inoperable	Replace Lock
Obstructed Drainage Holes	Clear Obstruction
Poorly Visible Well Designation	Relabel Well with Correct Designation
Well Siltation	
Difference of Measured Total Depth of Well and Historical Total Depth > 6 Inches	Remove siltation from well bottom.

Table 3-3
Well Purging and Sampling Field Data Sheet
Former Stanley Tools Site
Fowlerville, Michigan

Date	Sample Time	Well ID	Total Depth	Water Level	Purge Rate	Purged Volume	Turbidity	Eh	Dissolved Oxygen	pH	Conductivity	Temperature	Comments
													color:
												sheen: yes no	
											odor: yes no		
													color:
												sheen: yes no	
											odor: yes no		
													color:
												sheen: yes no	
											odor: yes no		
													color:
												sheen: yes no	
											odor: yes no		
													color:
												sheen: yes no	
											odor: yes no		

APPENDIX A
LABORATORY QUALITY ASSURANCE PROJECT PLAN

Available upon request



A **tyco** International Ltd. Company



STATE OF MICHIGAN
DEPARTMENT OF ENVIRONMENTAL QUALITY
LANSING



LENNI M. GRANHOLM
GOVERNOR

STEVEN E. CHESTER
DIRECTOR

February 23, 2006

Mr. Juan Thomas
U.S. Environmental Protection Agency, Region 5
77 West Jackson Boulevard
Chicago, Illinois 60604-3507

Dear Mr. Thomas:

Subject: Final Determination of a Mixing Zone Request; Johnson Controls, Inc. (JCI)
(former Stanley Tools); MID 099 124 299

The Michigan Department of Environmental Quality (MDEQ), Waste and Hazardous Materials Division (WHMD), has reviewed your request for a Mixing Zone Determination for venting groundwater to the Red Cedar River from JCI, in Fowlerville, Michigan. Your request was forwarded to the MDEQ, Water Bureau (WB). The WB's response to that request for a mixing zone determination is enclosed. The response the WB provided identifies the acceptable concentration limits for discharge of the various chemicals characterized in your mixing zone request to the Red Cedar River.

Based on the information provided, it is determined that there is a reasonable potential for the discharge of some chemicals to cause or contribute to water quality standards (WQS) being exceeded.

Recommended acute mixing zone-based groundwater surface water interface (GSI) values are summarized in the table below:

Table 1: Plume Venting to the Red Cedar River

Parameter	Final Acute Value (ug/L)	Chronic Value (ug/L)	Reported Worst Case Maximum Site Concentration (ug/L)
Trichloroethylene	3500	N/A	4200
Arsenic	680	N/A	161
Cadmium	77	N/A	13
Chromium, Hexavalent	32	N/A	20
Copper	144	N/A	103
Nickel	5800	N/A	1180
Cyanide, Free	44	N/A	10

General Comments

1. The final acute values listed above are the mixing zone-based GSI criteria. These limits are provided for chemicals determined to have a reasonable potential to exceed the acute mixing zone-based GSI criteria. These values, as well as the generic GSI criteria for other chemicals not specifically identified in the mixing zone request, must not be exceeded at the GSI compliance monitoring wells; if they are, further remedial action will be required. The facility has the following options in regards to parameters that exceed the acute mixing zone-based GSI criteria in on-site monitoring wells:
 - a. If exceedances are upgradient of the compliance monitoring wells, JCI must demonstrate that data from a final approved GSI compliance monitoring well system are, and will be, in compliance with acute mixing zone-based GSI criteria for those parameters. Averaging of groundwater data is not allowed for comparison to generic GSI or acute mixing zone-based GSI criteria, nor is it allowed for bioaccumulative contaminants of concern (BCCs). Acute mixing zone-based or generic GSI criteria may not be exceeded in any individual GSI compliance monitoring well.
 - b. The effluent limits for trichloroethylene are based upon Tier II water quality values. The facility does have the option to submit additional aquatic toxicity testing data that may allow for the development of less restrictive criteria, i.e., Tier I, for this parameter. The facility should contact the WB for guidance prior to conducting any additional testing.
 - c. Prevent the discharge of all parameters that exceed the acute mixing zone-based GSI criteria in the GSI compliance monitoring wells. This option would require the focus of subsequent site investigations to hydrogeologically define remediation designs for capturing the groundwater discharge, further plume characterization, and identification of sources for source control measures.
2. It has been determined that any other parameter not given a recommended mixing zone based GSI criteria in the table above, or in the enclosure, will not cause or contribute to WQS being exceeded at this time. This determination is based upon the reported maximum values in JCI's mixing zone request which was submitted to the WB by the WHMD.

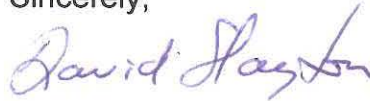
In order to demonstrate the groundwater discharge long-term compliance with the mixing zone-based GSI criteria, JCI will need to submit a Mixing Zone Compliance Monitoring Plan for review and approval. The Mixing Zone Compliance Monitoring Plan should include a Sampling and Analysis Plan, to address both mixing zone chemicals and other chemicals reported in the mixing zone request, identification of the wells that JCI proposes to sample to show compliance with the mixing zone-based GSI criteria (both along the GSI and within the appropriate portions of the plume), and provide an

explanation of the monitoring schedule and reporting process. Please submit the Mixing Zone Compliance Monitoring Plan to this office, within 60 days of receipt of this letter.

In addition to the specific Mixing Zone Compliance Monitoring Program, if any GSI compliance monitoring data show exceedances of the maximum value reported to the WB in the mixing zone determination request i.e., for chemicals reported in the mixing zone request but were shown to be meeting the GSI criteria, the data must be promptly evaluated by JCI to determine the significance and whether a new mixing zone determination request should be submitted to the WB. If there is an exceedance of the prior reported maximum value for any parameter of concern, please contact this office for further direction.

Should you have any questions regarding this letter or the Mixing Zone Determination, please contact me at slaytond@michigan.gov or by telephone.

Sincerely,



David Slayton
Hazardous Waste Technical Support Unit
Hazardous Waste Section
Waste and Hazardous Materials Division
517-373-8012

Enclosure

cc: Mr. Lee Carter, MDEQ
Mr. Steve Buda, MDEQ
Mr. Ron Stone/Mr. John McCabe/Mr. David Slayton/Reporting, MDEQ
HWS-CA File

CA 1.6 (299)

MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY

INTEROFFICE COMMUNICATION

TO: Liane J. Shekter Smith, Hazardous Waste Section, Waste and Hazardous Materials Division

FROM: Molly Rippke, Surface Water Assessment Section, Water Bureau

DATE: December 13, 2005

SUBJECT: JCI Former Stanley Tools - Mixing Zone Determination Request
National Pollutant Discharge Elimination System Permit #MID099124299

Please coordinate review/translation w/ Ron or Amy. Then notify comp and EPA.

→ Dave S.

DEC 15 2005

Waste and Hazardous Materials Division

Pursuant to your request, we have reviewed the November 14, 2005, request to develop mixing zones for groundwater venting from the JCI Former Stanley Tools site to surface waters of the state. Groundwater vents to the Red Cedar River at a rate of 0.01 cubic feet per second (cfs).

The Red Cedar River in the vicinity of the venting groundwater has 95% exceedance, harmonic mean, and 90Q10 flows of 2.3, 12, and 3.8 cfs, respectively. The parameters listed in Table 1 have been reviewed using the maximum reported discharge concentration for each parameter.

Recommended concentrations to maintain surface water quality standards (WQS) are summarized in Table 1.

Table 1. Recommended limitations for groundwater venting to the Red Cedar River.

	Parameter	CAS	Worst Case Discharge Concentration (ug/L)	Acute Value (ug/L)
TIER II	Trichloroethylene	79016	4200	3500
	cis-1,2-Dichloroethylene	156592	910	nr
TIER I	Vinyl chloride	75014	110	nr
	Arsenic	7440382	161	680
	Cadmium	7440439	13	77
	Chromium, hexavalent	18540299	20	32
	Copper	7440508	103	144
	Nickel	7440020	1180	5800
	Cyanide, free	57125	10	44

nr - no reasonable potential to exceed WQS.

Please contact me at 517-335-1125, if you have any questions.

mr:dp

cc: Brenda Sayles/Venting Groundwater File, WB